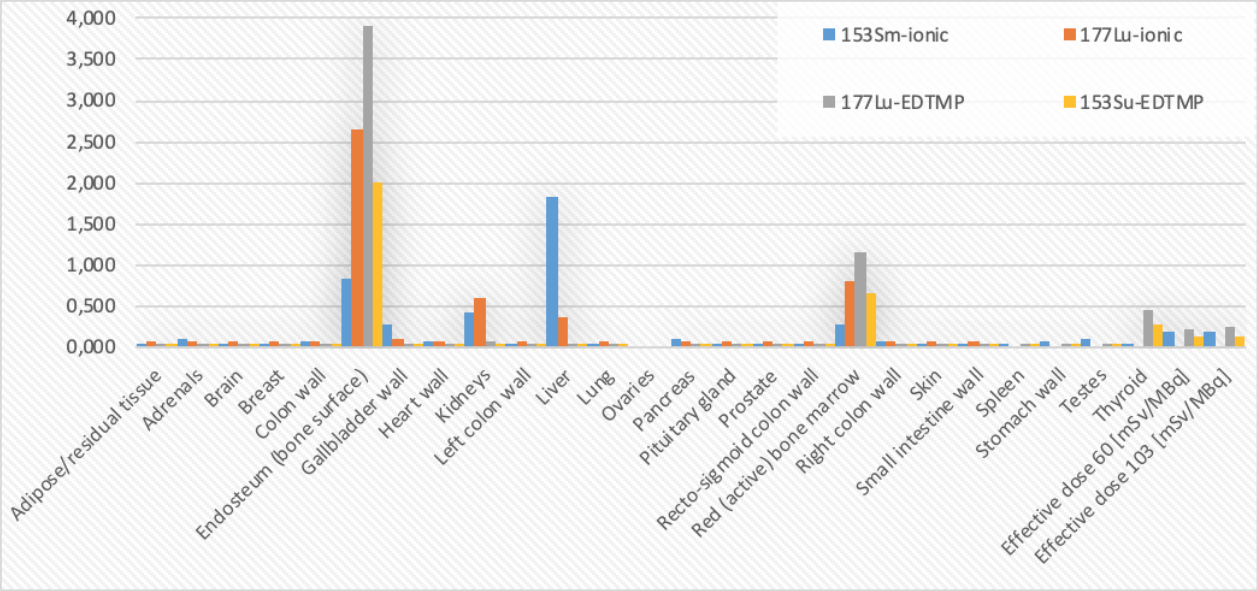

Fig. 1. Absorbed Dose in (mSv/MBq) in different organs and tissues

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TARGETED DRUG DELIVERY SYSTEM BASED ON MANGANESE-DOPED MESOPOROUS SILICA NANOPOWDER

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Abstract. The purpose of the research was to investigate the potential of using SiO_2-MnO_2 nanopowder, obtained by electron beam evaporation, as a drug delivery system. The evaluation of the sedimentation stability of suspensions was conducted for further in vivo studies. It was established that PEG stabilized suspensions showed the highest stability. Drug loading and release experiments with nanopowders demonstrated a high drug loading capacity of Amoxicillin and Doxorubicin.

Conventional drugs frequently exhibit high toxicity in healthy tissues that leads to reducing the injected dose because of increased risk of side effects, which seriously affects drug effectiveness during the therapeutic process [1]. Targeted drug delivery systems based on nanopowder (NP) can cope with these limitations.

Among the diverse nano-carriers based on Fe, C, TiO_2 and Au nanoparticles one of the most promising system for targeted drug delivery is SiO_2 NP which potentially have high porosity and specific surface area, the possibility of varying pore sizes, good

thermal, chemical stability and biocompatibility [2]. For the experiments, SiO_2-MnO_2 NP was chosen.

In order to determine the influence of sonication time on suspension stability, samples of NP suspensions (500 μg/ml) were sonicated in an ultrasonic bath for 40, 100, 150 min. Moreover, stability of NP suspensions (1 mg/ml) was determined by adding sodium citrate (CN) and polyethylene glycol (PEG) in a ratio of 1:1. Samples of SiO_2-5%MnO_2 NP were loaded with drugs by suspending 20 ± 0.5 mg of NP in 10.0 mL of aqueous solutions of Doxorubicin, Amoxicillin (1 mg/mL). For development of the most effective drug loading method, the first part of the samples after suspending was sonicated, while the second part of the samples was kept stirring. Then, suspended NPs were separated by centrifugation and washed with distilled water. The loading and release of drugs into NPs was determined by spectrophotometric method [3].

Sedimentation curves demonstrate a nonlinear dependence of the suspension stability on the sonication time. It was also concluded that specific surface area and porosity of samples decreased monotonically as the sonication time increased. The lowest sedimentation rate was shown by PEG stabilized suspension (8% in 15 min.).

The lowest loading capacity LC 0.0029 mg drug/mg NP was obtained for the sonicated sample Amo-SiO_2-5%MnO_2. This may be associated with the decrease in porosity during the sonication at the loading stage and, possibly, reduces the drug interaction with the surface of the carrier.

Stirred sample Amo-SiO_2-5%MnO_2 had a higher value of loading capacity LC 0.09 mg drug/mg NP. This result may be explained by stirring loading method, in which the porous structure of the NP should not be disturbed. Therefore, the method of drug loading has a significant influence.

To conclude, the researched SiO2-MnO2 NP obtained by the method of evaporation by a pulsed electron beam demonstrated the potential for its use as a drug delivery system.

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